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RESNICK

Diagnosis of

Bone *and* Joint Disorders

Fourth
Edition

volume **1**

Diagnostic Techniques
Spine Imaging
Postoperative Imaging
Basic Science



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VOLUME 1

Fourth Edition

Diagnosis of Bone *and* Joint Disorders

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Imaging after Surgery in Extraplural Sites; Imaging of Joint Replacement

PREFACE

The new millennium and right on schedule comes the fourth edition of *Diagnosis of Bone and Joint Disorders*. This, then, is the third time I have revised this text since its initial publication in 1981, more than 2 decades ago. Each time I have begun work on a new edition, I believed incorrectly that my job would be easier because, I thought, how much information could possibly have been introduced in the 5 or 6 years that had elapsed since the previous edition? And each time, without exception, I have been surprised by the progress that has occurred with regard to the further understanding and improved diagnostic assessment of the many diseases that affect the musculoskeletal system. So now, 7 years after the publication of the third edition, the fourth edition is offered as clear evidence that much has been learned, new concepts have emerged, and "old facts" have been modified or eliminated altogether.

I am often asked at the time of publication of a new edition precisely how much of the material is appearing for the first time. This is a difficult question to answer quantitatively. My educated guess is that 30 per cent of the information is new or has been modified significantly from that contained in the third edition, that the number of references has been expanded by 25 to 35 per cent (with emphasis given to pertinent recent publications), and that new illustrations represent 25 to 30 per cent of the total number appearing in this edition. With regard to the illustrative material, the new figures underscore the increasing importance of MR imaging as a vehicle for investigation of these diseases.

The size of the fourth edition does not differ significantly from that of the last edition, although the number of volumes has been decreased by one. (You will note that each is somewhat heavier than in the past!) To be certain that this multivolume book did not become too large, I consulted extensively with the experts at W.B. Saunders. You will note the following changes:

- Several previous chapters have been eliminated completely. These chapters either focused primarily on older imaging methods whose importance has decreased in recent years or contained material that was also detailed in other sections of the book.
- Several previous chapters have been combined to consolidate material and avoid redundancy.
- As the index for such a large text must be comprehensive (and, therefore, quite long), the complete index now appears only at the end of the fifth volume. To compensate for this change, a more abbreviated (but still useful) index appears in each of the other four volumes.

Certain topics have been addressed in detail for the first time in this fourth edition. These include digital imaging (Chapter 2), spinal interventional procedures (Chapter 11), cartilage imaging (Chapter 19), and disorders of muscle (Chapter 85). Furthermore, new authors have been recruited for many other chapters to offer a perspective different from that contained in the previous edition.

As I write this, with the fourth edition completed and ready for press, I am once again satisfied with the final product. I believe that the considerable efforts of the many persons responsible for this text will be evident to the readers. For my part, there were times during the process that the enthusiasm may have wavered a bit, but conversations with colleagues and timely phone calls to the publishers corrected this. In truth, writing my chapters and reading those provided by others contributed significantly to my own education. Further, I believe that the result will be similar for those who consult this book or, better still, read it in its entirety.

Donald Resnick, M.D.

PREFACE TO THE FIRST EDITION

I profess both to learn and to teach anatomy, not from books but from dissection; not from positions of philosophers but from the fabric of nature.

William Harvey (1578–1657)

De Motu Cordis et Sanguinis (1628)

An Anatomical Disquisition of the Motion of the Heart and Blood in Animals, translated from the Latin by Robert Willis (1847)

The roentgenographic features of many common and some not so common musculoskeletal disorders, particularly those that affect articulations, can be explained by closely correlating the radiographic, gross pathologic, and histologic abnormalities. Although this technique is not new, it is seldom applied to the evaluation of skeletal diseases. When radiographic and pathologic correlation was utilized in the past to analyze these diseases, the discussion generally centered upon primary bone neoplasms, which, although important, are rare occurrences indeed. The common “everyday” disorders have, in large part, been neglected, requiring the student of radiology to memorize lists of roentgenographic signs and differential diagnoses without regard to disease mechanisms and pathogenesises. Yet, the radiograph is but a mirror, and its image a reflection of the underlying anatomy and pathology. When the student is armed with an understanding of the basic pathologic aberrations of disease, perception of the “image” takes on new meaning.

There are several reasons why correlation of radiology and pathology is infrequently encountered in descriptions of many musculoskeletal diseases. Such studies require the close cooperation of two interested parties, a radiologist and a pathologist. For the radiologist, the development and the refinement of newer and more sophisticated diagnostic modalities, such as ultrasonography and computed tomography, have led to some degree of complacency and disinterest in the older and more established techniques of plain film radiography and standard tomography. The radiographic information presented by routine examination of the skeleton no longer evokes the excitement it once did, particularly when compared to the enthusiasm that accompanies an unusual sectional display on ultrasound or computed tomographic examination. For the pathologist, skillful and meticulous postmortem and surgical pathologic examinations have been neglected, in many institutions, in favor of histologic studies and complicated chemical analyses. Some regard anatomic pathology as “descriptive” in nature, static, and of little importance. Nothing is farther from the truth.

The difficulty in obtaining adequate pathologic mate-

rial is another reason for the infrequency of close radiographic and pathologic correlation in musculoskeletal disorders. The energetic investigator, however, can find several sources of such material. First, tissues can be obtained at postmortem examination. Although there is a general reluctance to remove large samples of bones and joints during autopsy, portions of the spine, sacroiliac articulations, symphysis pubis, sternum, sternoclavicular and acromioclavicular joints, and ribs can be examined in detail without deforming the body in any fashion. In certain situations, special permission to allow more extensive skeletal examination can be obtained, although this may require knowledge of the presence in a hospital of patients who are seriously ill and personal interviews with these individuals or their immediate family members. A second source of material is derived from surgical specimens. In many institutions, osseous and articular specimens are examined superficially, yet material obtained from total joint replacements, biopsy procedures, and amputations can shed light on many common and important disorders. A third source of pathologic material is the anatomy departments of nearby medical centers. Body donation programs exist in many such departments, and careful analysis of donated cadavers can uncover various musculoskeletal diseases. Body donation programs may also be associated with local chapters of organizations such as the Arthritis Foundation.

Once the material has been collected, meticulous radiographic and pathologic study is mandatory. We have routinely obtained radiographs and photographs of all intact specimens. Subsequently, tissue freezing with sectioning followed by radiographic and pathologic evaluation, or tissue maceration followed by similar evaluation, is useful. Histologic material can then be obtained from appropriate tissue sections.

This textbook utilizes such radiographic and pathologic correlation, wherever possible, in a variety of musculoskeletal disorders. Although the original intent of the authors was to discuss only “articular” problems, it soon became apparent that any discussion of joint diseases that did not encompass alterations of neighboring bones and soft tissue was incomplete. Thus, the scope of the textbook has been expanded to cover additional local and systemic disease processes, although in all cases articular findings are emphasized. The major portion of the discussion is directed toward radiographic and pathologic features that aid in accurate diagnosis, although some attention is focused upon major clinical and laboratory alterations. The methods and goals of therapy of the various diseases are not included as these are given in other available sources.

The organization of the material appears quite logical. Initially, developmental and comparative anatomy,

physiology, biochemistry, and biomechanics of articulations are studied. This discussion of the basic sciences is followed by an evaluation of the role of available radiographic and related modalities in the diagnosis of musculoskeletal diseases, of normal anatomic variants and artifacts that simulate disease, and of methods of classification of articular disorders. Subsequently, four chapters summarize the principles of medical and surgical examination in patients with articular diseases and of radiographic evaluation of the postoperative patient. In the remaining portions of the text, individual musculoskeletal disorders are evaluated. These are grouped into specific categories, although we recognize that some disagreement might exist regarding the manner in which the diseases are divided. In the final chapters, additional sites of abnormality are discussed, including the temporomandibular joint, soft tissues, and other organ systems. A summary of the patterns of distribution of articular abnormalities is included. Four appendixes consider additional diagnostic and investigative modalities. By design, some degree of overlap in discussion appears in certain segments of the book to provide emphasis.

The choice of contributing authors was made carefully and deliberately. Each is a recognized authority in the field of musculoskeletal disease and most are well known for their interest in the area of radiographic-

pathologic correlation. Although the writing style of one author might differ from that of another, these differences are minimal, and the terminology that is utilized is remarkably consistent throughout the textbook. Furthermore, great care has been exercised in the choice and in the preparation of the illustrations. When necessary, color photographs are used, and the orientation of the radiographic and pathologic material is such to facilitate correlation of the findings. A conscious effort has also been made to arrange many of the radiographs and photographs throughout the textbook in such a fashion that it appears that the same side of the body has been examined. This technique will enable comparison of disease processes discussed in different sections of the book. An extensive and up-to-date bibliography is included for those who might wish to consult pertinent references for additional information. Each reference has been carefully verified in the final stages of preparation to assure accuracy.

In conclusion, creation of this text has indeed been a labor of love. We sincerely hope that it will bring an equal amount of enjoyment to those who read it.

D. Resnick, M.D.

G. Niwayama, M.D.

ACKNOWLEDGMENTS

As always, I am indebted to many others who provided significant help during the preparation of this textbook. First, I would like to thank the many contributors who approached their task with a great sense of commitment. The quality of their chapters speaks for itself.

Long ago, I made the wise choice to establish a professional relationship with W.B. Saunders, an Elsevier Science Company. As was the case in previous editions, this latest edition, in large part, reflects the dedication of the many professionals at W.B. Saunders. Lisette Bralow, Executive Editor, Medical Books, has always served as my advisor and friend. I would like to thank her for her efforts and those of her able associates: Lee Ann Draud, Project Manager and Copy Editing Supervisor; Natalie Ware, Production Manager; Karen O'Keefe Owens, Designer; Walt Verbitski, Illustration Coordinator; and Sally Grande, Marketing Manager.

A radiology text requires the very best of illustrations.

As the legends indicate throughout this work, many of the illustrations were kindly donated by associates and friends, and I thank them all. I would like to mention one person, Doug Goodwin, who, almost monthly since his fellowship in 1993–1994, has been kind enough to send me his interesting cases, illustrations of which are scattered throughout the pages of this text. Doug, my thanks hardly seem sufficient.

Several other persons clearly deserve thanks as well. Susan Brown coordinated the illustrative material. Catherine Fix served as a copy editor in the early stages of the process. I am indebted to Joyce Velligan for her attention to detail during the typing of numerous passages in this text. Finally, Michael Holbrook and Debra Trudell, two of my most loyal associates, were again at my side during the whole process. To them, I express my sincere appreciation.

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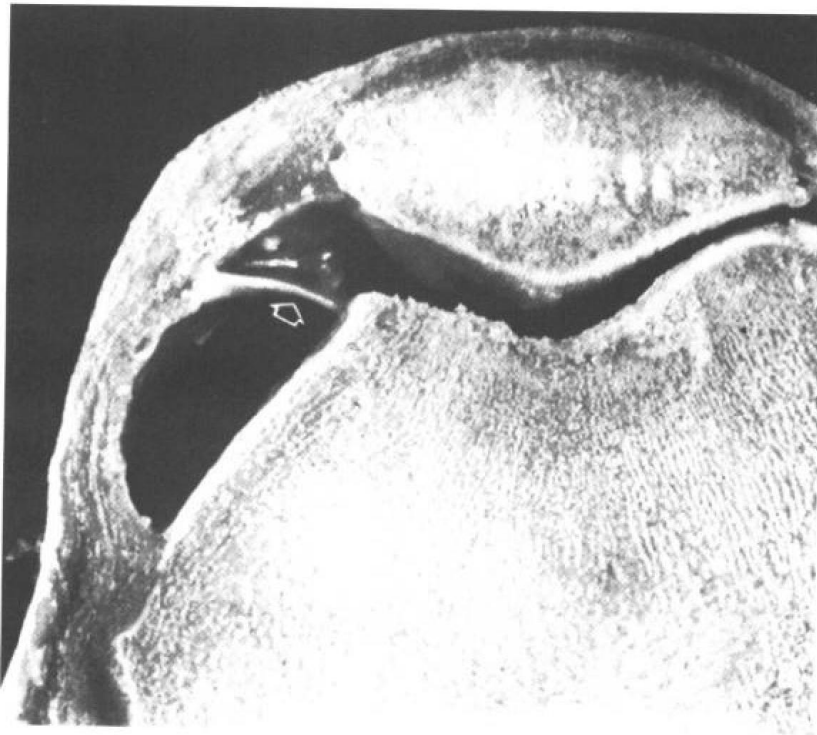
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Medial synovial plica: A transverse section of the knee at the level of the patellofemoral space reveals this prominent synovial fold (arrow).

